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FIRE ENDURANCE TEST
of
TWO BULKHEAD ASSEMBLIES

by

J. V. Ryan and E. W. Bender

for

U. S. COAST GUARD

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U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

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ABSTRACT

Two bulkhead assemblies were subjected to a standard fire test. The two differed only in the nominal density of the asbestos marine boards used. Each served as an effective barrier to flame passage for the full 60 minutes of the test. Excessive temperature rise was reached on the unexposed surface of the nominal 32 lb per cu ft board at 17.8 min. and on the nominal 37 lb per cu ft board at 17.0 min.

1. Introduction

At the request of Headquarters, U. S. Coast Guard (letter of 12 March 1962, MMT, JJ/164.008/48, JJ/164.008/49), two bulkhead specimens were subjected to fire test in compliance with Subpart 164.008-3(b) of Specification for Bulkhead Panels for Merchant Vessels.

2. Specimens

Each specimen was an assembly of two pieces of 7/8 in. (nominal) thick Marinite asbestos marine board, a snap-together metal joint member, metal channels on the two vertical edges, and metal base members and trim pieces. The details are shown in Figure 1 at the end of this report. The materials were received from the Johns-Manville Company but marked to indicate that the marine boards had been manufactured at Germiston, Scotland by Marinite, Ltd. The parts, all precut to size, were received unassembled; but those for each specimen were individually wrapped.

The two specimens differed only as to the nominal densities of the asbestos marine boards. Enough pieces for two specimens were received in good condition. Measurements made on each piece prior to assembly indicated the following:

Nominal		Mean Dimensions*			Actual
Density	Weight	Length	Width	Thickness	Density
lb/ft^3	lb	in.	in.	in.	lb/ft^3
32	30	94-7/8	16-15/16	.908	35.5
	55	94-7/8	29-3/4	.931	36.2
36	30.5	94-15/16	16-31/32	.906	36.1
	55	94-31/32	29-3/4	.920	36.6

*Mean of 3 to 5 measurements of length and width, 10 to 20 measurements of thickness.

In view of the unexpectedly high density of the nominal 32 lb board, samples were cut from each specimen after the fire test and their densities determined. The results failed to clearly indicate that the nominal 32 lb board had been received with an abnormally high moisture content.

Data submitted by Johns-Manville Company, on measurements made prior to cutting and shipping the pieces of board to the Bureau, indicated "normal" and dry densities of 34.5 and 33.2 lb/ft^3 for the nominal 32 lb board and of 36.2 and 34.9 lb/ft^3 for the nominal 36 lb board. The equilibrium relative humidity and temperature of the atmosphere corresponding to normal were not identified. It appears logical to expect that materials shipped by conventional transport would be received in conditions more representative of normal than of oven dry.

3. Test Method

The specimens were mounted in two openings of a test frame arranged to permit the simultaneous fire exposure of three bulkhead specimens in the wall test furnace. The third opening was closed with an insulated metal panel. The space between each vertical edge of each specimen and the furnace frame was filled with mineral wool; the mineral wool and metal edge channel were covered with a fillet of plaster on both the exposed and unexposed surfaces.

Eight thermocouples were placed on the unexposed surface of each specimen, distributed as shown in Figure 1. Each thermocouple junction and several inches of its lead wires were covered by a 6- by 6- by 0.4-in. felted asbestos pad. Twelve thermocouples, encased in porcelain insulators and iron pipes, were distributed within the furnace chamber. The furnace fuel was gas from the local municipal supply. The fuel flow was adjusted as necessary to produce average furnace temperatures as close as feasible to those of the standard time-temperature curve of ASTM E-119, which include: 1000°F at 5 min, 1300°F at 10 min, 1550°F at 30 min, and 1700°F at 1 hr.

4. Results

The test was conducted on March 16, 1962 and was witnessed by the following:

Paul Gibson, USCG
Roger Hale, USCG
George Hutchison, Marinite Ltd., London, England
K. H. Smith
A. J. Steneri
Burt Tower
J. F. Lynch
R. A. Greenbow

No cracks developed through either specimen during the test. The joint members bowed slightly toward the fire in the first few minutes but, after about 12 min, the joint members and marine boards bowed away from the fire. The test was stopped at 1 hr.

Both specimens remained effective barriers to flame passage throughout the test, there being no cracks in the unexposed surface. The limiting 250°F temperature rise at one thermocouple on the unexposed surface of the asbestos marine board was reached at 17.8 minutes for the nominal 32 lb per cu ft board specimen and at 17.0 minutes for the nominal 36 lb per cu ft board specimen. The fire exposure severity for the 1 hr test was 98.2 per cent. Additional temperature data are given in Figure 1. Examination after test showed that the base stools had not been deformed. The only metal deformations were sagging of the ceiling trim members and some warping of the exposed surface plates of the joint members.

5. Summary

The results of the test indicated that both specimens served as effective barriers to flame passage for 1 hr, and that the limiting temperature rise was reached at 17.8 min for the particular samples of nominal 32 lb per cu ft Marinite board and at 17.0 min for the particular samples of nominal 36 lb per cu ft Marinite board used in the specimens.

Neither the contents of this report nor the fact that the test was made at the National Bureau of Standards shall be used for advertising or promotional purposes.

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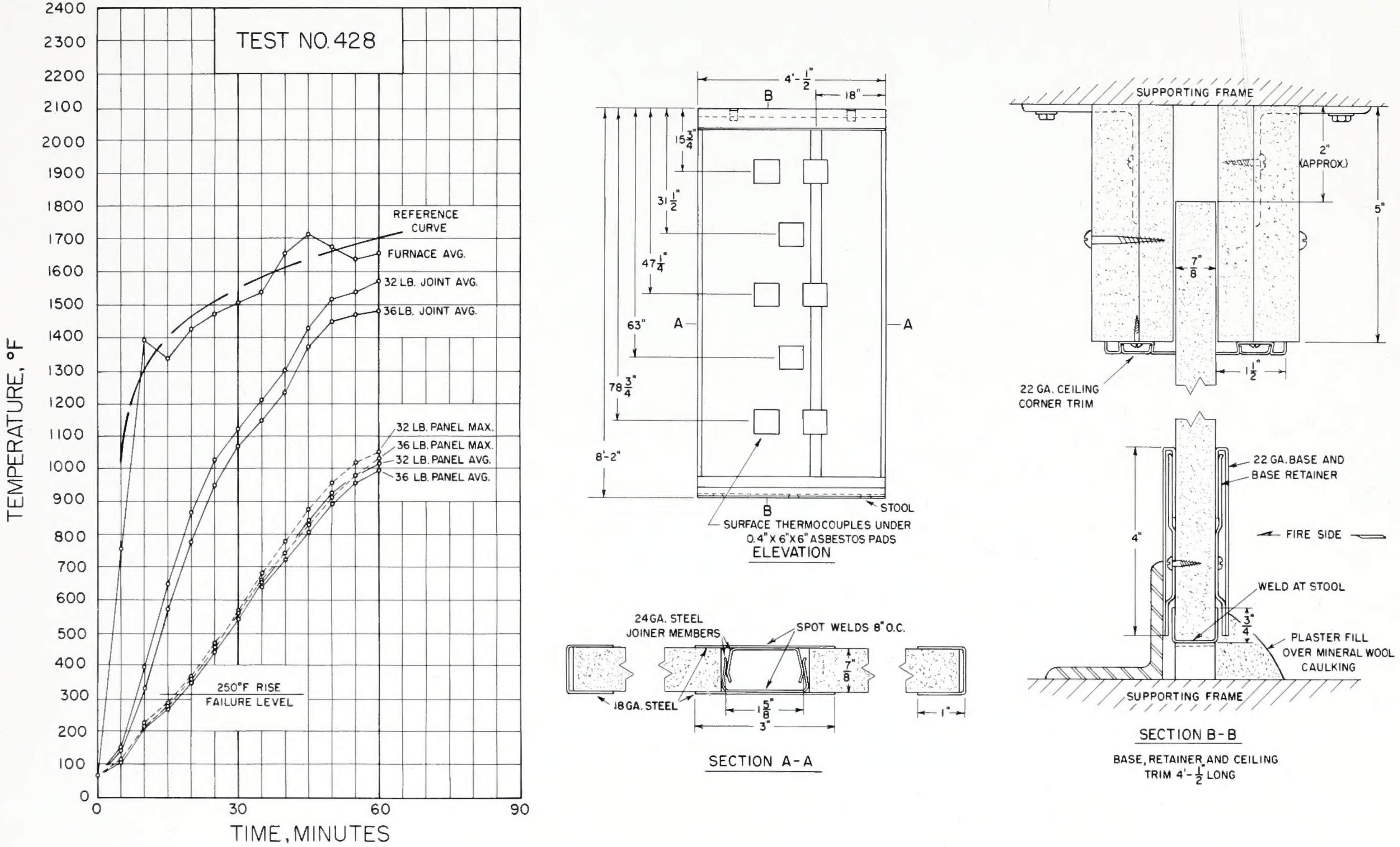

FIG. 1 - TEMPERATURE DATA AND CONSTRUCTION DETAILS